In this diploma thesis, selected techniques for construction of optimal portfolios are presented. Risk measures and other criteria (Markowitz approach, Value at risk, Conditional value at risk, Mean absolute deviation, Spectral risk measure and Kelly criterion) are defined in the first part. We derived analytical solution for some cases of optimization problems, in some other cases there exists numerical solution only however. Advantages and disadvantages, theoretical properties and practical aspects of software implementation in Wolfram *Mathematica* are also mentioned. Simulation methods suitable for portfolio optimization are briefly presented with their motivation in the second part. Multivariate distributions: normal, t-distribution and skewed t-distribution are presented in the third part with connection to optimization of portfolio with assumption of multivariate distribution of financial losses. Optimization methods are illustrated on real data in the fourth part of this thesis. Analytical methods are compared with numerical ones.